PATENT SPECIFICATION

643,931

Date of filing Complete Specification: June 20, 1949.

Application Date: May 19, 1948. No. 13577/48.

Complete Specification Published: Sept. 27, 1950.

Index at acceptance:—Class 110(ii), A1b5b, A2(e: v).

PROVISIONAL SPECIFICATION

Improvements in and relating to Gear Pumps, Fluid Motors and the like

We, AEROSTYLE LIMITED, a British Company, of 174/176, St. John Street, Clerkenwell, London, E.C.1, JOHN WEBB and RALPH BENJAMIN DIXON, both British Subjects, of the Company's address, do hereby declare the nature of this invention to be as follows:—

The present invention has reference to improvements in and relating to gear pumps, fluid motors and like machinery, the invention being concerned with the lubrication of these machines.

In accordance with the invention the machine is provided with a lubricant chamber which is in communication with the high pressure side of the machine and with a lubricant conduit or lubricant conduits which communicate with the said chamber and with the zone or zones to be lubricated, such as shaft bearings, the arrangement being such that lubricant in the chamber will be forced through the lubricant conduit(s) to the said zone or zones by the pressure of the fluid which flows to the chamber.

In the machine the inflow port of a duct for conveying pressure-liquid to the lubricant chamber is in the wall of the gear chamber at the pressure side thereof, said duct opening to the top of the lubricant chamber which is, of course, provided with means for sealing it other than at the ducts. The lubricant conduits terminate at the bearing surfaces of the gear shafts. The lubricant is forced to these surfaces and finally enters the gear chamber to lubricate the gears and the walls of the chamber. Lubrication is effected, therefore, in pumps and the like where the back pressure, directed through the bearing surfaces requiring lubrication is so much less than the outlet pressure, that the difference between the two pressures can be used to force a lubricating substance through the bearing surfaces. The lubricant is preferably grease.

It will be appreciated that the grease must have sufficient fluidity to flow along the conduits and that the rate of flow must be sufficiently low to prevent waste. A constriction, preferably an adjustable constriction, may be provided either in the pressure-liquid duct or in the lubricant conduit in order to limit the said rate of flow; or the effective size of the pressure-liquid duct and the position of the inflow port in relation to the pressure chamber of the pump may be so chosen that the required result is obtained. In connection with a gear pump we have found that the liquid-pressure on the pressure side of the gear chamber in the direction of the pitch circles of the gears decreases away from the meshing zone of the teeth and becomes zero or negative shortly before the plane containing the axes of the gears is reached. The inflow port of the pressure-liquid duct is therefore located at a point removed from the meshing zone such that the available pressure produces the required rate of flow of the lubricant having regard to the size of the duct and the size of the lubricant conduit(s). The said port and its duct may be located on a rotatable element enabling its position to be adjusted to suit temperature conditions and other factors concerned with the degree of fluidity of the lubricant. The duct will normally be in an end wall of the gear chamber but may be in the wall partly encircling a gear wheel.

If desired a piston, such as a leather cup or the like, may be arranged in the lubricant chamber for the purpose of isolating the pressure-liquid from the lubricant. The lubricant chamber may be provided with a grease charging nipple.

Dated this 19th day of May, 1948.

BROMHEAD & CO.,
Chartered Patent Agents,
229/230, Strand, London, W.C.2.

COMPLETE SPECIFICATION

Improvements in and relating to Gear Pumps, Fluid Motors and the like

We, AEROSTYLE LIMITED, a British Company, of 174/176, St. John Street, Clerkenwell, London, E.C.1, JOHN WEBB and RALPH BENJAMIN DIXON, both British Subjects, of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention has reference to improvements in and relating to gear pumps, fluid motors and like machinery, the invention being concerned with the lubrication of these machines.

In accordance with the invention the machine is provided with a lubricant chamber which is in communication with a part of the housing enclosing the gear teeth where a pressure exists which lies intermediate the input and output pressures and with a lubricant conduit or lubricant conduits extending to the zone or zones to be lubricated, such as shaft bearings, the arrangement being such that lubricant in the chamber will be forced through the lubricant conduit(s) to the said zone or zones by the pressure of fluid transmitted to the chamber.

In such an application more specifically a duct is provided for conveying pressure-liquid to the lubricant chamber having an opening in the wall of the housing enclosing the gears at the pressure side thereof, said duct leading to the top of the lubricant chamber which is, of course, provided with means for sealing it other than at the ducts. The lubricant conduits extend from the base of the chamber to the bearing surfaces of the gear shafts. The lubricant is thereby forced to these surfaces and finally enters the gear chamber to lubricate the gears and the walls of the chamber.

The position of the duct opening is selected so that a pressure substantially lower than the normal pump delivery pressure is transmitted into the ducts, such pressure being sufficient to distribute the lubricant at a rate ensuring good lubrication without excessive loss.

By the means referred to lubrication is effected in a gear pump or the like for gas or liquids where the back pressure, reaching the surfaces requiring lubrication is less than the outlet pressure; a pressure less than the outlet pressure but greater than the back pressure being used to force a lubricating substance through the bearing surfaces. A pressure less than the outlet pressure is chosen because, in normal cases, the outlet pressure is so high that serious loss of lubricant might occur if it were used directly and because with such high pressure it would be impracticable to regulate the delivery of lubricant to the requisite rate for correct lubrication without waste.

It will be appreciated that the lubricant, preferably grease, must have sufficient fluidity to flow along the conduits and that the rate of flow must be sufficiently low to prevent waste. A constriction, preferably an adjustable constriction, may be provided either in the pressure-liquid duct or in the lubricant conduit in order to limit the said rate of flow; or the effective size of the pressure-liquid duct and the position of its inflow port in relation to the pressure chamber of the pump may be so chosen that the required result is obtained.

The features of the present invention will be further described in greater detail by way of example.

Referring to the accompanying drawings:

Fig. 1 is a general view of the gear pump in part-sectional elevation,

Fig. 2 is a cross-section on line II—II of Fig. 1,

Fig. 3 is a plan view of Fig. 1, and

Fig. 4 is a view of one end cover of the pump carrying the lubricant chamber, seen in the direction of the arrow A on Fig. 2.

The liquid pump shown comprises a main body 5 enclosing meshing spur wheels 6, 7 rotating within part-circular housings in the usual manner. The liquid inlet is indicated at 8 and the outlet at 9. In the constructional embodiment shown a pressure relief valve 10 is provided to offer a by-pass path through conduits 11 in the event of the delivery being stopped e.g., by means of a control valve at the utilisation point. A branch outlet is shown at 12 in order that a second delivery may be provided; thus the main outlet 9 may feed a liquid spraying device while the branch outlet may provide a source of pressure liquid which may be used to operate stirring or agitating means in a storage tank for the liquid to be sprayed. A pressure gauge

13 may be connected to the main outlet 9 by means of an air chamber 14 which prevents the pressure liquid reaching the gauge mechanism.

The gear wheels 6, 7 are carried on shafts 15, 16 supported in end plates 17, 18 bolted or otherwise fixed to the sides of the body 5, one shaft being passed through a seal 19 in the end plate 17 to provide a drive shaft for the pump.

The other end plate includes a lubricant (i.e. grease) chamber 20 closed in a fluid-tight manner by a cap 21 and subjected to pressure at the upper end by a duct 22 opening in the face of the end plate adjacent one of the wheels 6 or 7 and at a point where an intermediate pressure reigns under normal operating condition between the delivery pressure and the input pressure. The point of opening of the duct is so selected that the pressure thereby made available is sufficient to effect delivery of the lubricant from the chamber 20 at a rate which ensures efficient lubrication of the working parts while avoiding unnecessary waste of the lubricant. As shown on Figs. 1 and 3 the said duct opens adjacent the sides of the gear teeth at a point where the teeth are enclosed by the part-circular housing and lying towards the delivery or output side or portion of said housing.

Delivery of the lubricant is effected through the delivery ducts 24 leading from the base of the chamber 20 to the bearings for the shafts 15, 16, said ducts including a portion 24^1 in the main body 5 and permitting both ends of the shafts 15, 16 as well as the seal 19 to be lubricated.

The position of the inlet to the duct 22 is selected so that it lies in a pressure zone where there exists pressure value which, applied through the said duct to the lubricant chamber 20, effects the distribution of the lubricant therein through the ducts 24, 24^1 at a rate which ensures efficient lubrication of the various parts of the pump without excessive loss. In this connection it is to be noted that in any type of pump or compressor there exists at appropriate points of the machine a pressure gradient between the inlet pressure and the outlet pressure and by appropriate selection of the position of the inlet to duct 22 any pressure within the range of said pressure gradient may be used. In all normal pumping and compressor installations, however, the output pressure, related to the back pressure acting through the bearing and other wearing surfaces, is too high to fulfil practical requirements if it were applied directly to a lubricant chamber like 20, since it would deliver an excessive amount of lubricant and would lead to wastage. For these reasons, therefore, the present invention contemplates taking the pressure from a point, appropriately chosen according to the particular design of pump concerned, where the pressure lies intermediate the inlet and outlet pressures and has a value selected to meet the requirement of circulating sufficient lubricant without incurring excessive loss. An adjustable valve or metering orifice may be provided in the pressure duct leading from the selected pressure zone or in the lubricant conduit, to control or regulate the flow of lubricant.

It should be pointed out that the fluid path through the pump from the inlet to the outlet includes spaces in the housings for the wheels 6, 7 through which the pump fluid circulates and under practical operating conditions the pressure increases progressively from the inlet to the outlet, and the inlet to duct 22 is positioned in the side face of said housing at a point where the requisite pressure is present to give the required lubricant circulation. The precise position of the duct inlet will be determined according to the characteristics and the applications of the pump, the position indicated on Figs. 1 and 4 being typical for liquid pumps operating at about atmospheric pressure on the inlet side and over the range of 50 to 150 pounds per square inch on the delivery side.

As shown on the drawings the duct inlet is shown in the side wall of the housing for the gears 6 or 7; it may, however, be in the housing wall partly encircling one of the wheels. Further the said duct inlet may be arranged in such manner that its position may be adjusted from time to time relatively to the gear wheel 7. For example the duct inlet could be provided in a rotatable adjusting body movable conveniently about the same axis as the shaft 16.

If desired the pressure fed through duct 22 to the lubricant chamber may act directly on the lubricant therein. Alternatively, an isolating element may be provided on the surface of the lubricant such for example as a cup leather or the like. Charging of lubricant may be effected by removing the cover 21 or by means of a feed nipple 25.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A gear pump, fluid motor or like machine embodying a lubricant chamber in communication with a part of the housing enclosing the gear teeth where a pressure exists which lies intermediate the input and output pressures and with a lubricant conduit or conduits extending to the zone or zones to be lubricated so that the lubricant is forced to the zone or zones by the pressure of the fluid transmitted to the said chamber.

2. A gear pump, fluid motor or like machine wherein a pressure duct communicates with a part of the housing enclosing the gear teeth subjected in normal operation to a pressure intermediate the input and output pressures and wherein said duct leads to one end of a lubricant chamber the other end of which communicates with a lubricant feed passage by which lubricant from said chamber is delivered to the parts of the pump or the like requiring lubrication and against the back pressure acting through said parts.

3. A gear pump, fluid motor or like machine wherein a restricted duct leads from a point of the housing enclosing the gear teeth subject to a pressure intermediate the inlet and outlet pressures and transmits said pressure to one end of a lubricant chamber from which lubricant is delivered to the working parts of the machine, the position of said duct inlet being so selected that the pressure fed thereinto is sufficient to effect delivery of the lubricant at a rate ensuring satisfactory lubrication without excessive loss.

4. A gear pump, fluid motor or like machine according to any of the foregoing claims and having pumping spaces in housings formed in a main body and end plates providing bearings for one or more shafts, wherein the lubricant chamber forms part of one end plate comprising a duct opening into one of said housings adjacent the delivery end and through which pressure fluid is delivered to the upper end of the lubricant chamber and lubricant delivery conduits through which the lubricant is delivered to the bearings and other working parts of the machine.

5. A gear pump for liquids comprising a pump body having part circular housings for meshing gear wheels driven by shafts journaled in end covers fitted to said housing, one of said shafts being extended to form a pump driving element, a lubricant chamber in one of said end covers, a duct for fluid pressure opening in the side wall of one of said housings towards the pressure side of the pump and at a point selected to drive a pressure value which gives efficient lubrication without excessive loss of lubricant, and lubricant delivery conduits leading from said chamber and arranged to feed the shaft bearings in said end covers and other working parts of the pump.

6. A gear pump, fluid motor or like machine according to any of the foregoing claims wherein the position of the duct through which pressure fluid is transmitted to the lubricant chamber to effect delivery of lubricant is adjustable relatively to the pump zones to permit control of the effective pressure transmitted to the lubricant chamber.

7. A gear pump, fluid motor or like machine according to any of the foregoing claims wherein the duct through which pressure fluid is transmitted to the lubricant chamber or the lubricant conduit includes an adjustable valve or a metering orifice to regulate the rate of delivery of lubricant.

8. A gear pump, fluid motor or like machine according to any of the foregoing claims wherein the lubricant chamber is provided with a removable cover.

9. A gear pump, fluid motor or like machine according to any of the foregoing claims wherein a cup washer or the like is provided within the lubricant chamber to separate the pressure fluid from the surface of the lubricant.

10. Gear pumps, fluid motors and the like substantially as herein described and illustrated.

Dated this 20th day of June, 1949.
BROMHEAD & CO.,
Chartered Patent Agents,
229/230, Strand, London, W.C.2.

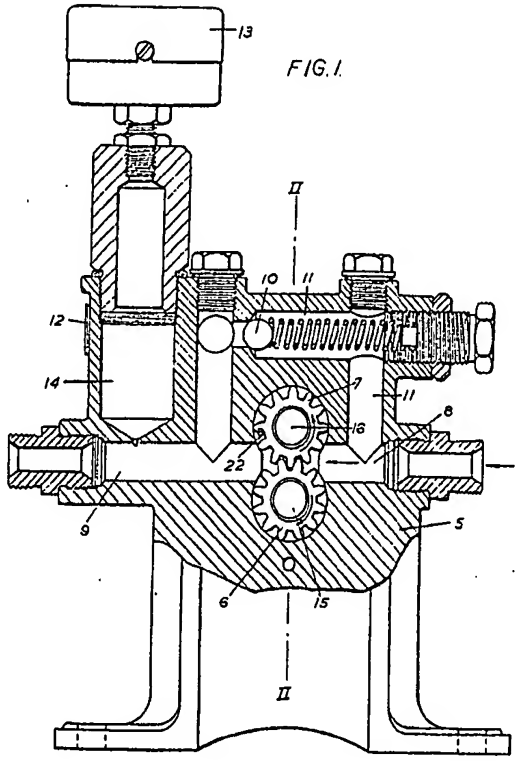
Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1950.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2. from which copies, price 2s. 0d. each (inland) 2s. 1d. (abroad) may be obtained.

643,931 COMPLETE SPECIFICATION

3 SHEETS

SHEET 1

FIG. 1.



SHEET 2

FIG. 2.

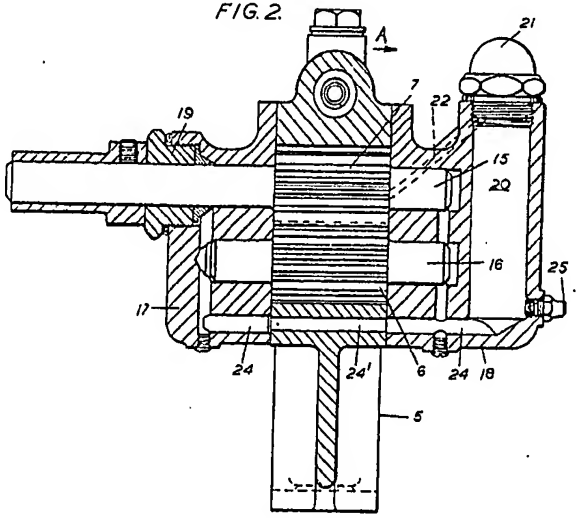
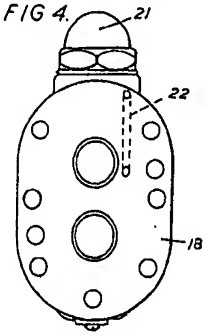


FIG 4.



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H.M.S.O. (Ty. P.)

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 3.